

Science Undergraduate Laboratory Internships (SULI)

Summer 2022 - Application for: James Raymond Good

APPLICANT PROFILE

General Applicant Information

First Name: James

Middle Name: Raymond

Last Name: Good

Previous Last Name(s):

Primary Email Address: jrg4ab@virginia.edu

Alternate Email Address 1:

Alternate Email Address 2:

ORCID: [0000-0002-4389-4863](https://orcid.org/0000-0002-4389-4863)

Current Address

Primary Phone Number: 571-271-2857

Alternate Phone Number:

Citizenship/Languages/Eligibility Information

I will be 18 years of age or older by the time the internship begins: Yes

Are you a U.S. Citizen? Yes

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EDUCATIONAL BACKGROUND

Academic Information

Are you currently attending a community college or 2-year college?

No

Current academic status:

Sophomore

If you are selected as a participant in this DOE program, will you receive academic credit from your university/college for participating?

No

Undergraduate Institution Information

College/University Country: United States and U.S. Territories

College/University State/Province/Territory:

Virginia

College/University Name: University of Virginia

College/University Address: P.O. Box 400160

College/University City: Charlottesville

College/University Zip Code: 22903

Expected/Declared Major: Physical Sciences - Astronomy - Astrophysics

Expected Degree From This College/University:

Bachelor's

Expected/Completed Graduation Date:

May / 2024

Transcript: UVA Unofficial Transcript.pdf

Does this institution provide grades? Yes

GPA Scale: 4.0

Total Attempted Credits: 49.00

Total Earned Credits: 49.00

Total Quality Points: 174.60

GPA: 3.56

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Science, Technology, Engineering and Mathematics (STEM) Courses

Course Title: Calculus I

Course Number: 1310

Enrollment Status: Recently Completed

Course Title: Calculus II

Course Number: 1320

Enrollment Status: Recently Completed

Course Title: Calculus III

Course Number: 2310

Enrollment Status: Recently Completed

Course Title: Elementary Labarotory II

Course Number: 2640

Enrollment Status: Currently Enrolled

Course Title: Intro Astrophysics I

Course Number: 2110

Enrollment Status: Recently Completed

Course Title: Intro Chemistry I

Course Number: 1410

Enrollment Status: Recently Completed

Course Title: Intro Chemistry II

Course Number: 1420

Enrollment Status: Recently Completed

Course Title: Intro Physics I

Course Number: 1710

Enrollment Status: Recently Completed

Course Title: Intro Physics II

Course Number: 1720

Enrollment Status: Recently Completed

Course Title: Intro to Astrophysics II

Course Number: 2120

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Enrollment Status:	Recently Completed
Course Title:	Modern Physics
Course Number:	2620
Enrollment Status:	Recently Completed
Course Title:	Observational Astronomy
Course Number:	3130
Enrollment Status:	Currently Enrolled
Course Title:	Ordinary Differential Equations
Course Number:	3250
Enrollment Status:	Recently Completed
Course Title:	PDE's and Applied Mathematics
Course Number:	4220
Enrollment Status:	Recently Completed
High School Graduation or GED	
Date of High School Graduation or GED:	June / 2020
Country:	United States
City:	Ashburn
State/Province/Territory:	VA

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WORK EXPERIENCE & SKILLS

Work Experience

Name of Place of Employment or Activity:	University of Virginia
Dates of Employment or Activity:	From 9/10/2021 To 12/17/2021
Hours Per Week:	2.0
Primary Duties:	Astronomy researcher for a "for-credit" research project.
Tasks Performed:	Recovered and analyzed planetary data and coded the relevant models in order to reconstruct an extra-solar protoplanetary disk.
Name of Place of Employment or Activity:	Doordash Driver
Dates of Employment or Activity:	From 6/10/2021 To Present
Hours Per Week:	10.0
Primary Duties:	Receiving food from the given restaurant and delivering it timely and safely to the customer.
Tasks Performed:	Took orders digitally, drove to place of commerce, transported food to customer.
Name of Place of Employment or Activity:	Restaurant Employee
Dates of Employment or Activity:	From 6/5/2018 To 8/14/2018
Hours Per Week:	30.0
Primary Duties:	Serving customers, preparing side dishes, taking orders, maintaining cleanliness.
Tasks Performed:	Cleaned dishes, prepared smaller side dishes and desserts, doing what was asked of me.
Name of Place of Employment or Activity:	Volunteer Accompanist
Dates of Employment or Activity:	From 1/18/2017 To Present
Hours Per Week:	1.0
Primary Duties:	Accompanying the cantor at St. Theresa Parish
Tasks Performed:	Played piano at masses at St. Theresa Parish in Ashburn, VA.

Professional Associations

Are you a member of any professional organizations?	No
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Computer Skills

Computer related skills:	Proficient in coding and writing in Matlab software. Capable in C++ programming language and Python. Proficient in Latex Editor and overleaf compiler.
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Laboratory/Technical Skills

Experience with advanced laboratory techniques or equipment:	Proficient in data collection and analysis techniques in laboratory physics, including: data analysis and error propagation, harmonic motion and waves, diffraction and interference, the Michelson interferometer, polarization, gas laws, DC circuits, the Lorentz force, and Faraday's laws. Proficient in CAPSTONE data analysis software and the relevant associated equipment (voltage monitors, position monitors, micrometers, oscilloscopes, etc.)
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PROGRAM INFORMATION

Eligibility

Have you previously participated in 2
SULI appointments? No

Previous DOE Internship/Fellowship or Lab Activity Experience

Have you ever had an
internship/fellowship with the
Department of Energy or any of its
National Laboratories (such as SULI,
CCI, VFP) or attended an activity at
one of the National Laboratories
(such as a Mini-Semester or
Sustainable Research Pathways)? No

Availability

What is the earliest date you can
begin your internship? 5/23/2022

When do you need to complete your
internship? 8/10/2022

First Choice Host DOE Laboratory

DOE Laboratory: Thomas Jefferson National Accelerator Facility (TJNAF)

First Choice Research Area: High Energy Physics

Second Choice Research Area: Nuclear Physics

Third Choice Research Area: Accelerator Physics/Science

Second Choice Host DOE Laboratory

DOE Laboratory: Princeton Plasma Physics Laboratory (PPPL)

First Choice Research Area: Astronomy/Astrophysics

Second Choice Research Area: Plasma and Fusion Sciences

Third Choice Research Area: Renewable Energy Sciences and Technologies

Relatives Employed at DOE Laboratories

Are you a relative of an employee at
the proposed host DOE laboratories? No

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ESSAYS

Research Experience: While studying at the University of Virginia, I had the opportunity to work on multiple laboratory projects in the physics department, in addition to an independent research project in the astronomy department. The physics laboratory projects were completed with a partner, and were supervised by a teaching assistant. During the course of the previous semester, I completed eight of these projects. Some of the most notable ones included experiments with diffraction, interference, the Michelson interferometer, circuits, the Lorentz force, and Faraday's laws. For each of these experiments, a lecture was attended to freshen up on the required physics, and a detailed independent report was written with the expected results, analysis, and error propagations included. A laboratory journal was kept during the course of the experiment in order to document data and methods. For the astronomy department, I completed a for-credit independent research project working closely with a professor. The course was designed to cover the entire research process, from recognizing project goals, to gathering and analyzing data, to experience with relevant coding and write-up techniques, to producing a finished final paper of decent quality and results. The research project was to reconstruct the protoplanetary disk of the HR 8799 system in order to determine the likelihood that other disks will form the type of enormous and distant planets that are in the HR 8799 system. Planetary data was gathered from previous studies in the astrophysics data system database, and applied to a relevant mathematical model using physics from orbital mechanics. The model consisted of a variety of different methods of dispersing the planetary material over the range of the disk in a surface density profile, and typical chi-squared methodology was used to parametrize the equations accurately. Figures were then designed using Matlab software to demonstrate the results in comparison with a variety of extra-solar disks, and were included in a final paper published using Overleaf. In addition, a minor physics project was done on the acoustical physics of the piano, and the relevant physics of string oscillations, resonance, and a brief analysis of the kinematics of the hammering mechanism were discussed. Further research experience includes research papers on the possibility of hydrocarbons in a subsurface ocean on Europa, and a paper on the observational techniques of Galilean and Keplerian astronomy.

Research Interests: I am fascinated by many areas of astronomy and physics, but there are a few areas which I am especially passionate about. I am passionate about maximizing efficiency and electrical output in our power plants and power line infrastructure around the country. Our current technology for producing and transporting electricity is archaic. There is a depressing amount of energy lost in the inefficient wires and in the wasteful heating mechanisms of many different types of power plants, not to mention the negative environmental effects of carbon based electricity production. It is amazing to me that nuclear power is not being taken advantage of more in the country. As a researcher, it would be my priority to work on discovering new, safe, and green ways to produce the copious amounts of electricity required of our huge global population. I would love to work on methods of refining the nuclear reactor, so that more energy is used from the binding energies of the nuclear reactions themselves and not simply from heating steam turbines. Furthermore, I am passionate about studying, designing, and implementing more magnetic and electrical based transportation, (anything to get rid of gasoline), as well as the inclusion of superconductors and their amazing non-heating physical properties into our day to day technological lives. While these types of projects can be accomplished practically at most laboratories, the accelerator facility at JLab, my first choice host laboratory, is the type of accelerator which is capable of conducting research on the smallest particles known and their strange properties. It will be through an accelerator facility that the next trillion dollar discovery is made which launches the world into the next technological era. Some way to harness or manipulate the immense amount of energy bound between quarks and through gluons would do wonders for humanity. Of course, the abundance of energy would lead to a more accelerated space exploration. We must discover what dark energy is and how it fits into the standard model. I believe that this can't be done on earth by universe observation alone. I would love to work on the observation and recording of first generation stars from the beginning of the universe or another relevant astrophysical field at my second choice host laboratory, PPPL, in order to further understand the four fundamental forces of nature, and their corresponding change in relevance since the beginning of the universe.

Personal Experience: I don't like to consider myself a math-oriented person. Despite the truth in that statement, I believe that it's inappropriate for people to wrap up their identities in such an illogical way. I have long been fascinated by the universe and its mysteries, but have only in the last two or three years truly discovered its enormity and the vastness of the unknown. I am blessed with a good memory and a strong retention for information. I have also found that I am capable of learning new things quickly and without requiring a lot of repetition. These skills have been very useful as I continue into advanced physics and astronomy. My academic experiences while studying at the University of Virginia are a part of what would make me a competent and innovative contributing member to the SULI program. I have experience with taking new information and demonstrating mathematical and physics skills through examinations and laboratory experiments, as well as experience with finding and analyzing data for research projects. Furthermore, I have experience with working with other people on solving problems, discussing methodology, and giving and receiving help on topics or equations in physics, math, and astronomy. I am also a participating member in the Society for Physics Students at UVA, in which I am able to work with colleagues closely on relevant projects, problems, or other academia.

While the experience is not STEM related, I was the vocal director for a theatre organization this past fall at UVA,

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	<p>where I was expected to learn the score and teach the vocals to the cast. This can be quite a challenging task when there aren't as many strong sight-readers or vocalists in the company. I, over the span of a few months, was successful at organizing vocal parts, teaching harmonies and melodies, and in some cases, re-arranging music to fit with our specific grouping, while also accompanying with piano at rehearsals. While this doesn't speak to my technical skills relevant to the SULI program, it speaks towards my ability to take in new information quickly and work on the fly to distribute it to other people in a way which is absorbable. My experiences as a vocal director account for my abilities to work with others in situations involving large amounts of new information or in areas in which tasks are expected of me.</p>
Professional Goals:	<p>I consider myself a very goal oriented person. I find it simpler to think of the world as a series of boxes to check off one by one. For the next two years, I will be finishing my bachelor of science degree at the University of Virginia. I am also an applicant for the SMART scholarship. If I am selected to participate in the SMART program, I will go to do research work for the department of defense for two years at a laboratory similar to the ones participating in the SULI program. Following my work there, it is my goal to return to a university to obtain a Ph.D. I believe that with a Ph.D I will be fully equipped with the knowledge and skills necessary to pursue the research and make the changes that I am passionate about. The SULI program will give me dexterity to excel in my undergraduate studies, as well as more experience in working on projects with others which I certainly will be doing more of in the future. Furthermore, the SULI program would give me an idea of doing research for the Department of Energy, which may give me a good idea of what to expect, should I be selected for the SMART program. If I am fortunate and capable to obtain a Ph.D in astrophysics, it is then my professional goal to pursue the research aforementioned. I am passionate about helping the planet with its energy crisis and discovering the new physics to launch humanity into the next era, as well as helping uncover the mysteries of dark matter and energy and their relevance to the standard model. If I am not able to learn about these topics directly in the SULI program, then the SULI program will give me the abilities to consume knowledge, corroborate information, and work with others to accomplish a goal, which are skills which I can take with me moving forward towards higher education and professional research. The SULI program would not only provide experience and skill development, but it would provide me with the opportunity to meet and work with other people. Having connections and colleagues is, of course, just as relevant and important in the modern day. The SULI program would give me the opportunity to make connections with potential future employers or researchers with similar hopes of discovering new physics to solve our crises.</p>

RECOMMENDATIONS

Recommendation 1:	<p>First Name: Nicholas Last Name: Ballering Email: nb2ke@virginia.edu Status: Received 1/10/2022</p>
Recommendation 2:	<p>First Name: Robert Last Name: Group Email: rcg6p@virginia.edu Status: Received 1/6/2022</p>

James Raymond Good

01/05/2022

Test Credits

Test Credits Applied Toward Arts & Sciences Undergraduate

Transferred to Term 2020 Fall as				
CHEM	1410	Intro College Chemistry I	TE	3.00
Repeated: Repeat-Include in GPA Only				
CHEM	1420	Intro College Chemistry II	TE	3.00
Repeated: Repeat-Include in GPA Only				
ENGL	1000T	Non-UVa Transfer/Test Credit	TE	3.00
ENWR	1000T	Non-UVa Transfer/Test Credit	TE	3.00
HIST	1000T	Non-UVa Transfer/Test Credit	TE	3.00
HIST	1000T	Non-UVa Transfer/Test Credit	TE	3.00
MATH	1310	Calculus I	TE	4.00
MATH	1320	Calculus II	TE	4.00
PHYS	1425	General Physics I	TE	3.00
PLCP	1000T	Non-UVa Transfer/Test Credit	TE	3.00

Test Credit Total: 26.00

Transfer Credits

Transfer Credit from Northern Virginia CC Annandale
Applied Toward Arts & Sciences Undergraduate Program

Incoming Course				
SPA DE	202	Dual Enrollment Interm.Span.		
Transferred to Term 2020 Fall as				
SPAN	1000T	Non-UVa Transfer/Test Credit	PT	3.00

Incoming Course				
SPA DE	201	Dual Enrollment Interm.Span.		
Transferred to Term 2020 Fall as				
SPAN	1000T	Non-UVa Transfer/Test Credit	PT	3.00

Incoming Course				
HIS	203	History of African Civ I		
Transferred to Term 2020 Fall as				
HIAF	2001	Early African History	PT	3.00

Incoming Course				
CHM	112	College Chemistry II		
Transferred to Term 2020 Fall as				
CHEM	1420	Intro College Chemistry II	PT	3.00
Repeated: Repeat-Include in Credit Only				

Incoming Course				
Transferred to Term 2020 Fall as				
CHEM	1000T	Non-UVa Transfer/Test Credit	PT	1.00

Incoming Course				
CHM	111	College Chemistry I		
Transferred to Term 2020 Fall as				
CHEM	1410	Intro College Chemistry I	PT	3.00
Repeated: Repeat-Include in Credit Only				

Incoming Course				
Transferred to Term 2020 Fall as				
CHEM	1000T	Non-UVa Transfer/Test Credit	PT	1.00

Transfer Credit Total: 17.00

Beginning of Undergraduate Record

School:		2020 Fall			
Major:		College & Graduate Arts & Sci			
ASTR	2110	Intro to Astrophysics I		B	3.0
ENWR	1510	Writing and Critical Inquiry		A	3.0
Course Topic:		Writing about Culture/Society			
MATH	2310	Calculus III		A	4.0
PHYS	1710	Introductory Physics I		A-	5.0
Curr Credits		15.0	Grd Pts	55.500	GPA 3.700
Cuml Credits		15.0	Grd Pts	55.500	GPA 3.700

School:		2021 January			
Major:		College & Graduate Arts & Sci			
AMST	2559	New Course: AMST		A	3.0
Course Topic:		The Good, the Bad, & the Ugly			
Curr Credits		3.0	Grd Pts	12.000	GPA 4.000
Cuml Credits		18.0	Grd Pts	67.500	GPA 3.750

School:		2021 Spring			
Major:		College & Graduate Arts & Sci			
ASTR	2120	Intro to Astrophysics II		A-	3.0
MATH	3250	Ordinary Differential Equatns		B+	4.0
MUSI	4582	Composition II		A-	3.0
PHYS	1720	Introductory Physics II		B+	5.0
Curr Credits		15.0	Grd Pts	51.900	GPA 3.460
Cuml Credits		33.0	Grd Pts	119.400	GPA 3.618

School:		2021 Fall			
Major:		College & Graduate Arts & Sci			
ASTR	4993	Tutorial		A-	3.0
MATH	4220	PDEs and Applied Math		B+	3.0
MUPF	2121	Performance (Piano)		CR	1.0
MUSI	3050	Music and Discourse		A-	3.0
PHYS	2620	Modern Physics		B	4.0
PHYS	2630	Elementary Laboratory I		A-	3.0
Curr Credits		17.0	Grd Pts	55.200	GPA 3.450
Cuml Credits		50.0	Grd Pts	174.600	GPA 3.563

School:		2022 Spring			
Major:		College & Graduate Arts & Sci			
ASTR	3130	Observational Astronomy			4.0
EVSC	2200	Plants, People and Culture			3.0
MUPF	3120	Advanced Performance (Piano)			2.0
PHYS	2640	Elementary Laboratory II			3.0
SPAN	2010	Intermediate Spanish			3.0

End of Undergraduate Record

SULI PROGRAM APPLICATION RECOMMENDATION FOR JAMES RAYMOND GOOD

Recommender Contact Information

- **First Name:** Robert
- **Last Name:** Group
- **Title:** Associate Professor
- **Department:** Physics
- **Institution/Organization:** UVA
- **Telephone:** 630-200-1879
- **Email:** rcg6p@virginia.edu

Applicant Information

Association

Describe your relationship to the applicant, including how long you've known the applicant, where, and in what capacity.

I first met him when James took a Modern Physics class from me in the Fall semester of 2021. The Modern Physics class is the first physics major class. There are 68 potential physics majors in the class, and the class is quite challenging, covering all topics of Modern Physics. James earned a solid B in the class. This is in the top half. While he was not at the very top of the class, he impressed me in several ways. He worked hard and improved considerably throughout the semester. He often asked insightful questions in class and after class. He was always respectful and genuinely curious. He attended every single class and completed every assignment. It was a pleasure to have him there as he has a very positive disposition and often contributed to in-class discussions.

Applicant Comments

Please provide substantive comments about the applicant's education, training, aptitude, or promise relevant to the SULI program. Include any relevant additional detail or perspective regarding the applicant's research experience or equivalent experience on complex projects, including the level of independence or other factors that would contribute to the applicant's ability to make an excellent contribution to the SULI program.

I first met him when James took a Modern Physics class from me in the Fall semester of 2021. The Modern Physics class is the first physics major class. There are 68 potential physics majors in the class, and the class is quite challenging, covering all topics of Modern Physics. James earned a solid B in the class. This is in the top half. While he was not at the very top of the class, he impressed me in several ways. He worked hard and improved considerably throughout the semester. He often asked insightful questions in class and after class. He was always respectful and genuinely curious. He attended every single class and completed every assignment. It was a pleasure to have him there as he has a very positive disposition and often contributed to in-class discussions.

Applicant Rating

In comparison to other undergraduate students, please rate the applicant relative to his/her peers on the following qualifications:

	Do Not Know	Below Average	Average	Above Average	Superior
Analytical and Mathematical				X	
Experimental Research	X				
Overall Academic			X		
Initiative and Self Reliance				X	
Motivation toward Scientific Career				X	
Originality of Thought				X	
Emotional Maturity				X	
Ability to Work with Others				X	
Potential for Leadership				X	
Oral Communication Skills				X	
Written Communication Skills				X	

SULI PROGRAM APPLICATION RECOMMENDATION FOR JAMES RAYMOND GOOD

Recommender Contact Information

- **First Name:** Nicholas
- **Last Name:** Ballering
- **Title:** none
- **Department:** Astronomy
- **Institution/Organization:** University of Virginia
- **Telephone:**
- **Email:** nb2ke@virginia.edu

Applicant Information

Association

Describe your relationship to the applicant, including how long you've known the applicant, where, and in what capacity.

James Good worked closely with me at the University of Virginia from August to December 2021 on an astrophysics research project to derive the properties of the primordial planet-forming disk that gave rise to the well-studied HR8799 planetary system. The project involved reviewing the relevant scientific literature, exploring various mathematical descriptions for the disk structure, coding and plotting these models with the MATLAB software package, using computing tools to explore a wide range of model parameters to quantify the best fit, interpreting the results within the larger context of planet formation, and writing a report describing the project.

Applicant Comments

Please provide substantive comments about the applicant's education, training, aptitude, or promise relevant to the SULI program. Include any relevant additional detail or perspective regarding the applicant's research experience or equivalent experience on complex projects, including the level of independence or other factors that would contribute to the applicant's ability to make an excellent contribution to the SULI program.

James possesses a strong foundation in mathematics and scientific thinking. He made tremendous progress in his coding ability this semester. We regularly discuss papers related to our project, and James has learned to effectively navigate and digest the scientific literature. He is quick to make connections between concepts learned in his coursework and the research project. James is attentive during meetings and completes all tasks quickly and as assigned. While he doesn't always take the initiative to go well beyond what was assigned, his work was of high quality. He exhibits a mature and confident professional demeanor that will serve him well in the future. I believe James is a strong candidate for the SULI program. Please feel free to contact me if you would like any additional information regarding my experiences with him.

Applicant Rating

In comparison to other undergraduate students, please rate the applicant relative to his/her peers on the following qualifications:

	Do Not Know	Below Average	Average	Above Average	Superior
Analytical and Mathematical					X
Experimental Research				X	
Overall Academic	X				
Initiative and Self Reliance			X		
Motivation toward Scientific Career				X	
Originality of Thought			X		
Emotional Maturity				X	
Ability to Work with Others				X	
Potential for Leadership				X	
Oral Communication Skills			X		
Written Communication Skills				X	